TABLE 1 OF § 1066.130—SUMMARY OF REQUIRED CALIBRATIONS AND VERIFICATIONS—Continued

Type of calibration or verification	Minimum frequency [a]
40 CFR 1065.340: CVS calibration.	This calibration does not apply for CVS flow meters calibrated volumetrically as described in § 1066.140.
40 CFR 1065.345: Vacuum leak.	Required upon initial installation of the sampling system; recommended within 35 days before the start of an emissions test and after maintenance such as pre-filter changes.
40 CFR 1065.350(c), 1065.355(c), 1065.370(c), and 1065.375(c).	These provisions do not apply for testing under this part; see § 1066.150.
40 CFR 1065.395: Inertial PM balance and weighing.	These verifications do not apply for testing under this part.

[a] Perform calibrations and verifications more frequently if needed to conform to the measurement system manufacturer's instructions and good engineering judgment.

§ 1066.135 Linearity verification.

This section describes requirements for linearity verification that are unique to testing under this part. (Note: See the definition of ''linearity'' in 40 CFR 1065.1001, where we explain that linearity means the degree to which measured values agree with respective reference values and that the term ''linearity'' is not used to refer to the shape of a measurement instrument's unprocessed response curve.) Perform other required or recommended calibrations and verifications as described in 40 CFR 1065.307, with the exceptions noted in this section.

(a) For gas analyzer linearity, use one of the following options:

(1) Use instrument manufacturer recommendations and good engineering judgment to select at least ten reference values, y_{refi}, that cover the range of values that you expect during testing (to prevent extrapolation beyond the verified range during emission testing). We recommend selecting zero as one of your reference values. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2% or less of the value at each data point, concentration values may be calculated by use of a straight-line curve fit for that range. If the deviation exceeds 2% at any point, use the best-fit nonlinear equation that represents the data to within 2% of each test point to determine concentration. If you use a gas divider to blend calibration gases, verify that the calibration curve produced names a calibration gas within 2% of its certified concentration. Perform this verification between 15 and 50% of the full-scale analyzer range.

(2) Use the linearity requirements of 40 CFR 1065.307, except for CO_2 measurements used for determining fuel economy and GHG emissions for motor vehicles at or below 14,000 pounds GVWR. If you choose this linearity option, you must use the provisions of 40 CFR 1065.672 to check for drift and make appropriate drift corrections.

(b) For dilution air, diluted exhaust, and raw exhaust sample flow, use a reference flow meter with a blower or pump to simulate flow rates. Use a restrictor, diverter valve, variable-speed blower, or variable-speed pump to control the range of flow rates. Use the reference meter's response for the reference values.

(1) *Reference flow meters.* Because of the large range in flow requirements, we allow a variety of reference meters. For example, for diluted exhaust flow for a full-flow dilution system, we recommend a reference subsonic venturi flow meter with a restrictor valve and a blower to simulate flow rates. For dilution air, diluted exhaust for partial-flow dilution, and raw exhaust, we allow reference meters such as critical flow orifices, critical flow venturis, laminar flow elements, master mass flow standards, or Roots meters. Make sure the reference meter is calibrated and its calibration is NIST-traceable. If you use the difference of two flow measurements to determine a net flow rate, you may use one of the measurements as a reference for the other.

(2) *Reference flow values.* Because the reference flow is not absolutely constant, sample and record values of $\dot{Q}_{refi}$ for 30 seconds and use the arithmetic mean of the values, $\bar{\dot{Q}}_{ref}$, as the reference value. Refer to 40 CFR 1065.602

for an example of calculating an arithmetic mean.

(3) *Linearity criteria.* The values measured during linearity verification for flow meters must meet the following criteria: $| x_{min}(a_1-1)+a_0 | \leq 1\% \cdot \dot{Q}_{max}$; $a_1 = 0.98-1.02$; $SEE = \leq 2\% \cdot \dot{Q}_{max}$; and $r^2 \geq 0.990$.

(c) Perform linearity verifications for the following temperature measurements instead of those specified at 40 CFR 1065.307(e)(7):

(1) Test cell ambient air.

(2) Dilution air for PM sampling, including CVS, double-dilution, and partial-flow systems.

(3) PM sample.

(4) Chiller sample, for gaseous sampling systems that use thermal chillers to dry samples, and that use chiller temperature to calculate dewpoint at the chiller outlet. For testing, if you choose to use the high alarm temperature setpoint for the chiller temperature as a constant value in determining the amount of water removed from the emission sample, you may verify the accuracy of the high alarm temperature setpoint using good engineering judgment without following the linearity verification for chiller temperature. We recommend that you input a simulated reference temperature signal below the alarm setpoint, increase this signal until the high alarm trips, and verify that the alarm setpoint value is no less than 2 °C below the reference value at the trip point.

(5) CVS flow meter inlet temperature.

(d) Perform linearity verifications for the following pressure measurements instead of those specified at 40 CFR 1065.307(e)(8):

(1) Exhaust back pressure at the tailpipe exit.

(2) Barometric pressure.

(3) CVS flow meter inlet pressure.

(4) Sample dryer, for gaseous sampling systems that use either osmotic-membrane dryers or thermal chillers to dry samples. For your testing, if you choose to use a low alarm pressure setpoint for the sample dryer pressure as a constant value in determining the amount of water removed from the emission sample, you may verify the accuracy of the low alarm pressure setpoint using good engineering judgment without following the linearity verification for sample dryer pressure. We recommend that you input a reference pressure signal above the alarm setpoint, decrease this signal until the low alarm trips, and verify that the alarm setpoint value is no more than 4 kPa above the reference value at the trip point.

(e) When following procedures or practices that we incorporate by reference in §1066.1010, you must meet the linearity requirements given by the procedure or practice for any analytical instruments not covered under 40 CFR 1065.307, such as GC–FID or HPLC.

§1066.140 Diluted exhaust flow calibration.

(a) *Overview.* This section describes how to calibrate flow meters for diluted exhaust constant-volume sampling (CVS) systems. We recommend that you also use this section to calibrate flow meters that use a subsonic venturi or ultrasonic flow to measure raw exhaust flow. You may follow the molar flow calibration procedures in 40 CFR 1065.340 instead of the procedures in this section.

(b) *Scope and frequency.* Perform this calibration while the flow meter is installed in its permanent position, except as allowed in paragraph (c) of this section. Perform this calibration after you change any part of the flow configuration upstream or downstream of the flow meter that may affect the flow-meter calibration. Perform this calibration upon initial CVS installation and whenever corrective action does not resolve a failure to meet the diluted exhaust flow verification (i.e., propane check) in 40 CFR 1065.341.

(c) *Ex-situ CFV and SSV calibration.* You may remove a CFV or SSV from its permanent position for calibration as long as the flow meter meets the requirements in 40 CFR 1065.340(c).

(d) *Reference flow meter.* Calibrate each CVS flow meter using a reference flow meter such as a subsonic venturi flow meter, a long-radius ASME/NIST flow nozzle, a smooth approach orifice, a laminar flow element, or an ultrasonic flow meter. Use a reference flow meter that reports quantities that are NIST-traceable within ±1% uncertainty. Use this reference flow meter's